CARNIVOROUS PLANT NEWSLETTER

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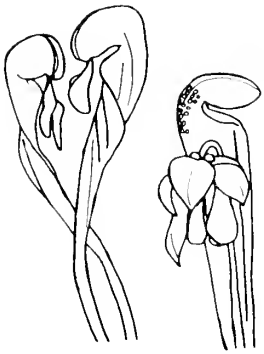

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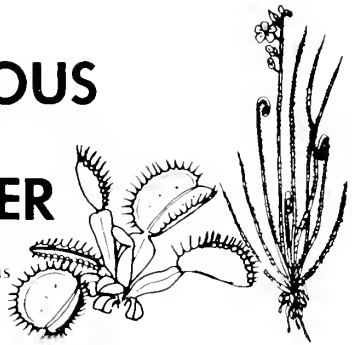

COVER PHOTOS

Front: Rosette plant and lower pitcher of *Nepenthes sanguinea.*

Back: Lower pitchers of *Nepenthes sanguinea.*

See story, page 65. Photos by Roger Shivas

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to Mrs. Pat Hansen, 3321 Hamell Rd., Fullerton, CA 92635. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to CSUF FOUNDATION-ICPS.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the December issue is October 15, 1983.

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News and Views

TOM CARPENTER (21334 Park Mount Drive, Katy, Texas 77450) writes: Would you expect a natural CP population in the middle of the South's largest city? A small population of *Drosera brevifolia* is maintaining itself in an open, regularly mowed sandy area adjacent to a Houston city park. The writer has visited the location several times over the past three years during which time the population seems to have neither enlarged nor declined.

Recently, the writer contacted Mr. Dianni in East Texas (CPN News and Views, Dec. '82) concerning a *Sarracenia alata* population about to be destroyed. Mr. Dianni still intends to bulldoze, drain, and convert the location to grazable pasture. However, as of March '83, the population was still intact. The writer found the plants to be heavily infested with Exyra moths. Also present were *Drosera capillaris* and *Utricularia subulata.*

From CHRIS LUHDORFF (6473 Sierra Drive, Coulterville, CA 95311): Have you ever been stumped on what to give as a gift to a friend or loved one? In my family, a home-made gift has more sentimental value than something from the store, and so I suggest the following: If you live in the mountains, as I do, go out and collect pieces of "bark-like" wood that can be whittled. Carve out a cup-shaped indentation, then fill it with soil. This makes a good planter for *Drosera.* If the indentation is deep enough, you can plant *Dionaea* or *Cephalotus* in it.

If you live near the beach, you can collect shells that are deep enough to fill with soil and use as planters. Use your imagination. See what you can come up with! (Ed. note: *Please respect any regulations regarding collection of materials from protected areas.)*

JOE MAZRIMAS reports: I had over 60 orders for the new K. Kondo book and all orders were processed on time. It is not economically feasible for me to process single orders, so for all those who would like to order a book, please send an international Money Order of $10.00 to:

Dr. Katsuhiko Kondo
Faculty of Integrated Arts & Sciences
Hiroshima University
Hiroshima 730, JAPAN

For those of you who like to send pictures and slides for publication in CPN, we urge you to send us pictures of top quality. It costs us the same price to publish the good ones as it does the bad quality pictures. You may send color or B & W photos,* 35 mm slides or larger size slides. It is better for these pictures to be slightly overexposed (about ½ stop) than to be dark since some darkening occurs in the reproduction process. Most of the features in these images should be in sharp focus and plants should fill nearly the entire field for best details to show. It's difficult to see the plants if the picture is taken many feet away. All pictures will be returned at the request of the author. Please include a couple of sentences about the plants in the picture, especially where the plants were found and the ecology of the area.

**Glossy photos, please.*

Sarracenia purpurea
drawing by Ron Fleming

In this issue:

International Carnivorous Plant Society
SEED BANK*

Patrick Dwyer (St. Michael's Episcopal Church,
49 Killean Park, Albany, NY 12205)

Byblis liniflora (8)
Darlingtonia californica
Dionaea muscipula
Drosera aliciae (4)
D. auriculata (10)
D. burkeana (10)
D. capensis
D. capensis (narrow) (5)
D. capillaris
D. indica (10)
D. intermedia
D. lovellae (10)
D. montana (2)
D. peltata
D. pygmaea (4)
D. rotundifolia
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D. spath. (Kansai)
D. spath. (Kanto)
D. spath. (white fl.)
Drosophyllum lusitanicum (10)
Nepenthes gracilis
N. khasiana
N. mirabilis
Pinguicula alpina (10)
P. corsica (10)
P. grandiflora pallida (6)
P. vulgaris
P. vulgaris bicolor (2)
Sarracenia alata (12)
S. flava
S. leucophylla
S. purpurea purpurea
S. rubra (3)
S. × *chelsonii* (8)
S. flava × *minor* (2)
S. leuco × *alata* (5)
S. rubra × *leuco* (5)

*For details on how to send or order seed, please see *CPN*, March 1983, page 4.

A Preliminary Report on the Pollination of *A Sarracenia purpurea* in a Forest-Swale Ecotone

by

Wendy O'Neil, Director, Natural Area Registry Program,
The Nature Conservancy, 531 N. Clippert, Lansing, MI 48912
edited by Larry Mellichamp

Abstract

This study was conducted during the summer of 1979 while the author was a student at the University of Michigan Biological Station, near Pellston.

Sarracenia purpurea flowers (161 flowers) were studied for a period of 29 hours during anthesis over a nine-day interim. Visitors to the flowers were collected in hope of establishing the pollinator(s) of the plant. Members of the Halictidae (a cosmopolitan family of small black or brightly metallic solitary bees) primarily were caught and thought to be acting as pollinators. *Bombus terricola* (bumblebee) females were also collected and may play a minor role in pollination. Other insects, including flies and beetles, were found as visitors, although they were unlikely pollinators.

Introduction

Sarracenia purpurea L. is an insectivorous plant that grows commonly in Northern sphagnum bogs. Although first described in 1601, it was not until a century later that Dr. Michael Sarrasin of Quebec sent specimens of this plant to Tournefort in Paris (Harper, 1918). Work on *Sarracenia* has focused on the insectivorous nature of the plant and the ecological interactions within the pitcher-shaped leaves (Istock et al., 1975).

Pollination studies, by comparison, have been fewer and less detailed. Schnell (1978) mentions a small species of *Bombus* as a possible pollinating agent for *Sarracenia rubra*. In 1965, Adrienne Mandossian of Michigan State University completed a doctoral thesis on the life history of *Sarracenia purpurea* in a sphagnum bog habitat

in Northern Michigan. In it, she concluded that major visitors to her plants were: *Sarcophaga sarraceniae* (a fly), *Bombus impatiens, B. griseocollis, B. terricola, B. vagans, Apis mellifera* and several species of ants. Results of her study also indicated that cross-pollination provided a larger amount of seed set than self-pollination, and that non-pollination provided almost no seed set.

In *Sarracenia purpurea,* flowers are borne on peduncles 3-5 mm high with five dark red petals that droop. There are five persistent sepals and three bracts. The flower goes through three main stages: young, medium, and old. Young flowers are those that have recently opened and still bear petals and anthers. Medium-aged flowers have dropped petals and most of the stamens. Older flowers have no petals or stamens left. At functional maturity the flower is held upside down at the tip of the bent-over flowering stem. During anthesis, nectar is secreted at the base of the barrel-shaped ovary. Should nectar be unremoved from the plant it collects and runs down the ovary.

Materials and Methods

The study site was a wet forest-swale (low dunes) ecotone along the shore of Lake Michigan located at Grass Bay, in section 25 of T38N, RIW, and section 30 of T38N, RIW, Cheboygan County, Michigan.

Field observations were made by checking flowers along a 290 meter transect that ranged from 5 to 10 meters in width. Flowers were observed between 0830 and 1630 hours. 161 *Sarracenia* flowers were checked for visitors during 29 hours of observation spread over 9 days.

Flower visitors were normally not visible until the petals were cautiously pulled back. If an insect was inside, the petals were replaced and a net placed over the flower. The time was recorded and the insect captured upon exiting from the flower. It was necessary to allow the insect to leave the plant of its own accord so that pollen present on its body would be the result of its own activity rather than a by-product of the capture procedure. Captured insects were placed in a potassium cyanide killing vial and later pinned for a voucher collection.

Insects were examined for pollen loads under a dissecting microscope. Pollen loads were removed from some of the halictid bees and treated with glycerine jelly, 95% alcohol and methyl green using a method described by Kapp (1969). The loads were then examined under a compound microscope to determine whether or not *Sarracenia* pollen was present.

Flowers that were at the young, medium and old stage of anthesis were bagged with cotton gauze and left covered from mid-afternoon July 6, 1979 until the morning of July 8, 1979. Nectar was sampled from these flowers with micropipets and placed on a pocket refractometer in order to measure sugar concentration.

To establish that flowers were actually being pollinated, a return visit to the site was made on August 12th to check for capsule and seed production.

Results

A total of sixteen types of insects were found visiting the inner portion of the *Sarracenia* flower. The stage of anthesis seemed to affect the nature of visitor. Twelve insect types were found visiting the young and medium-aged plants whereas four types were found on old flowers.

Bees gathered from the flowers were determined as follows: one visitor was an *Osmia* sp. (Megachilidae); two bumblebees were identified as *Bombus terricola* (Apidae) females; and 43 Halictidae, although not officially identified, were thought to be the same species of small bee.

One of the *Bombus* was found inside a flower. It had forced its way in between a petal and the stigma. The other *Bombus* was observed crawling in over the stigma and exiting between a petal and sepal. Microscopic examination revealed white *Sarracenia* pollen on both bees. Only on two other occasions were *Bombus* seen near the plants. Of these, one was in flight and the other approached a pitcher flow-

Preservation of *Nepenthes* Pitchers by Freeze Drying

Roger G. Shivas, Botany Department,
National University of Malaysia, Bangi, Selangor, Malaysia

Dried and pressed herbarium specimens of *Nepenthes* do not clearly exhibit many of the characteristics of the living plant. In particular dried pitchers often lose their original shape and form. However, it is often the shape of the pitcher which has been used to identify the many species and natural hybrids of *Nepenthes*.

Curators of zoological museums have preserved small animals by the method of freeze drying. This method of preservation has a wider application in microbiology and packaging certain foodstuffs.

The method of freeze drying requires leaving the material to be preserved in a vacuum at a temperature of about -50° C. The period of time that material is left in the freeze drier depends upon the nature of the material. Bacterial cultures are generally freeze dried for 4 hours, whereas a small bird may require a week of freeze drying.

Nepenthes pitchers were freeze dried for 24 hours using the apparatus available at the Zoology Department, National University of Malaysia. The pitchers maintained their original shape and to a certain extent their colour. Pitchers preserved by this method were obtained from plants of *Nepenthes macfarlanei, Nepenthes sanguinea, Nepenthes albo-marginata* and *Nepenthes ampullaria*. The freeze dried pitchers were only slightly brittle and durability might be obtained by coating the pitchers with a clear varnish paint or spray.

Pollination (from page 61)

er and at the last second avoided it.

The Halictid bees were found inside the pitcher blossoms repeatedly. Several times they were found perched amongst the stamens, with their heads facing the base of the ovary. Most commonly, they were found wandering around inside on the stylar disc which was covered with pollen. Usually they exited a pitcher plant blossom between the petals and the sepals, or between the stylar disc and petal, nearly always making a short flight to the sepals and resting there while combing gathered pollen onto the tibia of their hind legs. On two occasions, bees were observed leaving the flower across the stigmatic surface.

The other bee collected was not seen on any other occasion. It was an *Osmia* sp. and carrying pollen on the underside of the abdomen.

Twenty-eight members of the family Sarcophigidae, probably *Sarcophaga*, were seen on pitcher blossoms. These flies were rarely found in the young flowers. Instead they were noted on flowers of medium and old ages.

Other insects collected from the flowers included fireflies (Lampyridae) – old flower; click beetle (Elateridae) – medium flower; wasps (Sphecidae) – young flower; midges; ants; cranefly; mosquito. None of these was considered to be involved with pollination.

When Halictid pollen loads were examined, *Sarracenia* pollen was determined to be white in color. Its stephanolcolporate pollen grains were easily identifiable under high-power magnification. Four out of fourteen bees examined had pollen from at least one other species in addition to *Sarracenia* pollen.

Nectar results showed a sugar concentration ranging from 17.2% (wt/wt) in old flowers to 35.2% (wt/wt) in young flowers. The nectar production was also found to decrease with flower age.

Discussion

Since the *Sarracenia* flowers were already opened when the study period began it was not possible to undertake manipula-

(Continued on page 74.)

Plate A Lower pitcher of *Nepenthes macfarlanei* prior to freeze drying.

Photos by Roger Shivas

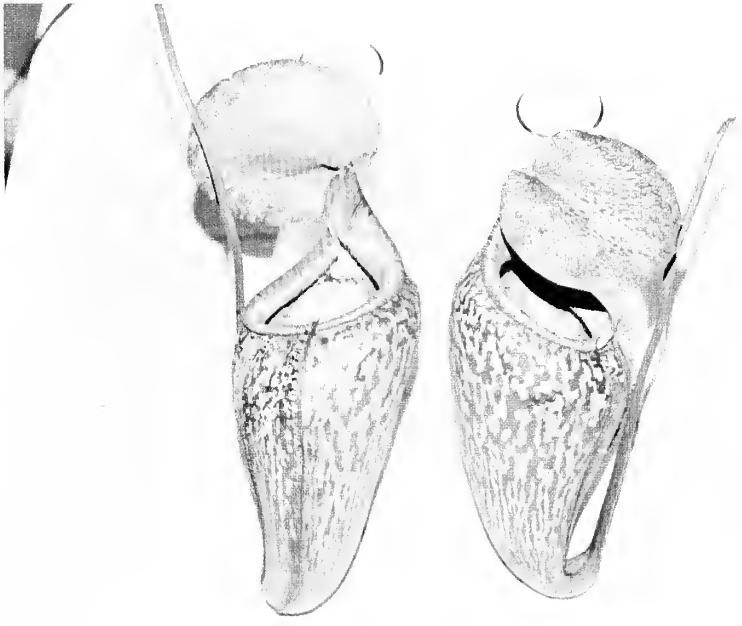


Plate B Freeze dried pitchers of *Nepenthes macfarlanei*.

Nepenthes mirabilis variation

by Bruce Lee Bednar (25 Lake Court Loop, Ocala, FL 32672)

The *mirabilis* complex, this common form of Nepenthes, is variable. The different forms often have been given separate identities as species, but eventually were recognized as variations of a single specie. Some of the plants in circulation have acquired incorrect names accidentally, or sometimes fraudulently to increase trading value to put as much mileage on them as possible. The problem of old synonyms occurs with plants mostly out of Europe where many *mirabilis* are still labelled *phyllamphora*, an abandoned name not used in decades.

The plant in CP trade labeled *kampotiana* is not at all the original plant described by Lecomte. The true species is not believed to be in cultivation at this date. Instead, the bogus "kampot" is thought to be a natural hybrid between *mirabilis* and *thorelii*, and has appeared on newer collectors' lists unofficially labelled × *lecouflei*. To add more wood to the fire, there is doubt to the authenticity of "thorelii-long green." Lecomte's paper on *thorelii* is difficult to obtain, if it's still around at all. Many feel "thorelii-long green" is the Thailand *mirabilis*, and the pubescent leaved, squat pitchered "short round" is the true species. If this is so, many hybrids using *thorelii* as a parent are mislabeled and plants like × *hachiyo* and × *effulgent koto* would be intergrades, not hybrids.

I've seen very little information on the species *anamensis* described by Macfarlane as a highland variety. The one in cultivation seems also to be a *mirabilis* variant. The light green pitcher, maroon and green wavy leaves are too similar to the other *mirabilis* types of the Indo-China area.

Two other plants have been brought to my attention as being bogus. One which seems to have been renamed in Australia somewhere along the line is *geoffrayi*, another plant of Lecomte. I have not seen the bogus type which is typical *mirabilis*, obviously labelled so as to increase its popularity. The true specie *geoffrayi* is not at all similar to *mirabilis*, and there would be no room for confusion in identifying the two.

Smillesii is another example, truly a *mirabilis* with a "new name." The plant has been around for years; rename it and once again the plant sells.

A new monograph is needed for the genus *Nepenthes*. The *mirabilis* complex needs much work itself. Until a standard is achieved, many *Nepenthes* collectors will remain lost. In the next few years many plants not in cultivation will become available. It is very important to be able to properly identify them so others can confidently rest assured what they have labelled is really what they have. Any comments?

NEW PLANT AND SEED SOURCES

	Catalogue Price	*Stock*
Carnivorous Supplies P. O. Box 179 Albion Park N.S.W. 2527 AUSTRALIA	International Reply Coupon	CP Seed

	Catalog Price	*Stock*
The Cottage Nursery Moortown Road, Nettleton Lincs LN7 6HX ENGLAND	?	CP

Nepenthes of Gunung Ulu Kali

Roger G. Shivas
Botany Department, National University of Malaysia, Bangi, Selangor, Malaysia

The Genting Highlands are situated about 40 km northeast of Kuala Lumpur in tropical Malaysia. The highest mountain in this part of the range is Gunung Ulu Kali (1800 m). Presently the area is being developed as a tourist resort and boasts four hotels, a golf course, and a casino.

Gunung Ulu Kali is often shrouded in cloud and rainfall in the area is high. The temperature ranges between the extremes of hot days (30° C) and cool nights (10° C).

The vegetation on the ridges and crests is upper montane moss forest characterized by stunted trees of *Dacrydium* and *Leptospermum,* several species of *Rhododendron* and other ericaceous shrubs and many epiphytic orchids. The top soil is peat, which is often covered in dense mats of sphagnum moss.

Three species of *Nepenthes* have been recorded from Gunung Ulu Kali, *Nepenthes macfarlanei, Nepenthes gracillima* var *major* and *Nepenthes sanguinea* (Stone, 1981). During 1982 and 1983, I made several trips to Gunung Ulu Kali to observe and collect Nepenthes.

Nepenthes macfarlanei is a robust plant with waxy leaves and was the most abundant plant species in the moss forest. This species was readily distinguished by its cream-coloured, crimson-spotted upper pitchers and large, ovate (10 to 15 cm high and 5 to 8 cm wide), mottled red lower pitchers. Plants often reached lengths greater than 4 m.

Nepenthes gracillima, although not as plentiful as *Nepenthes macfarlanei,* was easily identified by its dark purplish-black, cylindrical pitchers (10 to 20 cm high and 1 to 3 cm wide). Mature plants were vines greater than 5 m in length. The form of this species found on Gunung Ulu Kali most closely fits *Nepenthes gracillima* var *major* (Ridley, 1924).

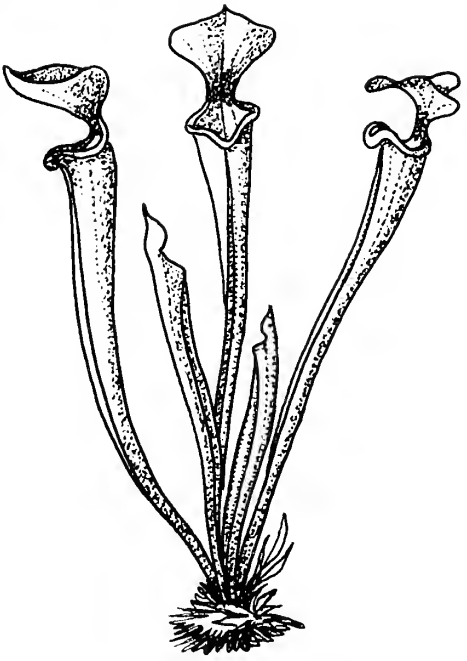
Nepenthes sanguinea was rarely found on the ridges and crests of Gunung Ulu Kali. However, this species was found along roadside embankments at an altitude 300 m lower than the summit. *Nepenthes sanguinea* was conspicuous with its wide peristome (1 to 2 cm) and cylindrical pitchers (10 to 20 cm high and 3 to 6 cm wide). The colour of the pitchers varied from pale red and green to a dark, uniform blood red.

Literature Cited

Ridley, H.N. (1924) *The Flora of the Malay Peninsula, III.* London, L. Reeve & Co., p. 22.

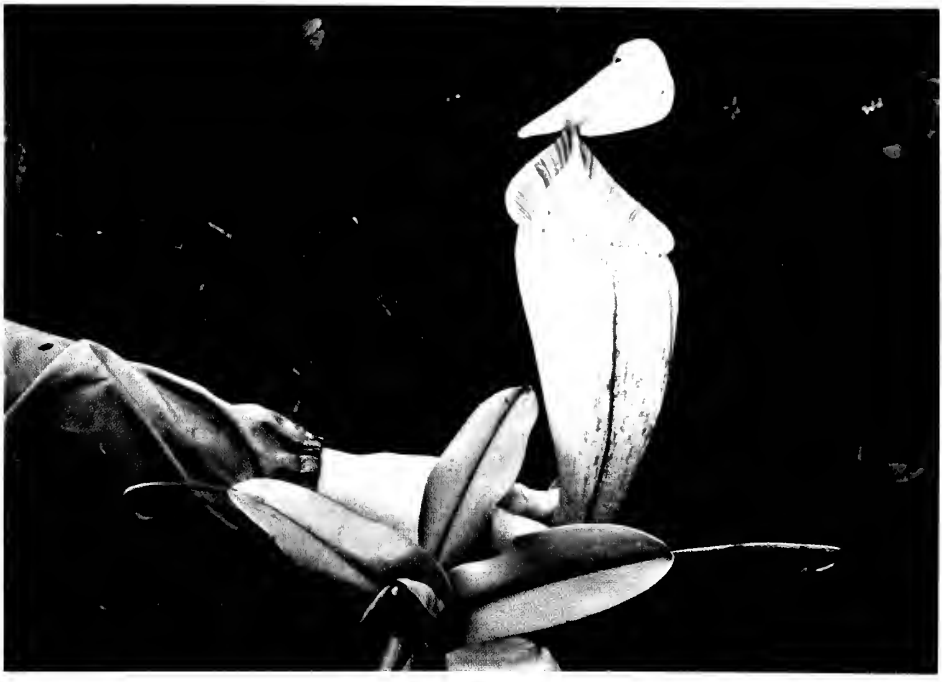
Stone, B.C. (1981) The summit flora of Gunung Ulu Kali (Pahang, Malaysia). *Federation Museums Journal,* Kuala Lumpur, Volume 26 (Part 1), N.S.

(See front and back covers as well as photos, pages 66-7).



Sarracenia flava

Drawing by Ron Fleming



Upper pitcher of Nepenthes macfarlanei.

Photo by Roger Shivas

Lower pitcher of *Nepenthes macfarlanei.*

Photo by Roger Shivas

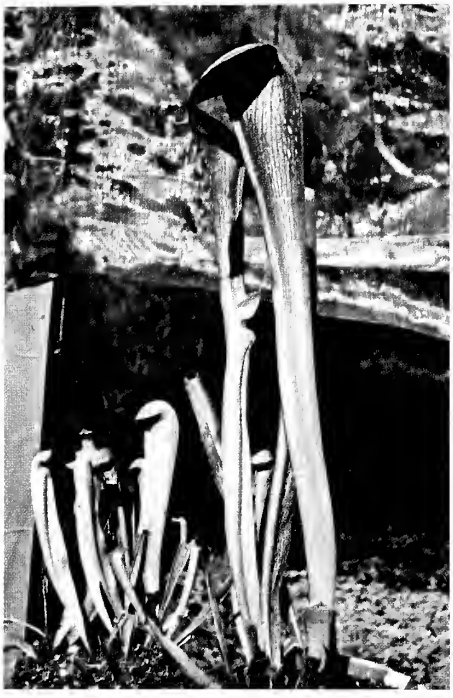


Figure 1—The smaller plants are green *S. alata* × *minor* (North Carolina), and the larger plants are the red-throated *S. alata* × *S. minor* (Okefenokee).

Figure 2—*S. alata* red-throated × *S. flava* heavy-veined.

Photos above by Steve Clemesha.

Distinctive purplish-black pitchers of *Nepenthes gracillima.*

Photo by Roger Shivas

THE INFLUENCE OF DIFFERENT FORMS OF *SARRACENIA* SPECIES ON THEIR HYBRIDS

by Steve Clemesha
(Lot 6 Skinner Close, Avocado Heights, Woolgoolga, NSW Australia 2456)

Two Sarracenia hybrids that I made about 14 years ago were *S. alata* × *S. minor* and *S. alata* × *S. flava*. In both cases the common green form of *S. alata* was used while the *S. minor* was also the common form—a plant from North Carolina, and the *S. flava* was the heavy-veined form.

The two hybrids matured. The *S. alata* × *S. flava* are tall green plants. The pitchers are slender and they have some red veins. The pitcher tops and hoods show the influence of *S. flava* but they are not as large or spectacular as in that species. The plants produce good pitchers right through the growing season and like the *S. alata* parent, plants produce offsets freely.

The *S. alata* × *S. minor* does not grow very large. Most pitchers are 20 cm or less tall, rather like *S. minor* in shape but lacking its colour. Only two or three small light window spots are found on the upper pitcher back, and these could be easily missed unless looked for. The main contributions *S. alata* made in this hybrid were its green colour and freely offsetting habit. In all the two hybrids are easily grown, but are not very colourful.

Four years ago, I repeated the crosses using the form of *S. alata* with red inside the hood, the large Okefenokee Swamp form of *S. minor* and the form of *S. flava* that has a red pitcher with a green hood that is red veined. The plant of *S. flava* is from Florida.

The hybrids using these parents are strikingly different from those made earlier. The *S. alata* × *S. flava* is now nearly mature. Its pitcher shape is much like that of the earlier hybrid but the young pitchers by the time they are open are red from the pitcher rim to the base. The hood at first is green with red veins inside and out. After a few days, the green becomes golden and soon after this the hood becomes solid red inside and out. The colour is particularly intense on the inside of the hood where it is almost black-red. Late summer and autumn pitchers colour as fully as spring ones. In winter the pitcher tops die but the live bases remain red.

In the *S. alata* × *S. minor* hybrid the plants are also more colourful. The upper third of the pitchers and hoods are reddish-brown, and the hood interiors are solid red, though this is not easily seen because of the *S. minor*-like shape. The upper pitcher back has numerous white spots.

The most outstanding feature of this hybrid, however, is its size. Pitchers are 50-55 cm tall. They taper from their narrowest point at the base to their widest at the pitcher mouth where they are 5 cm from front to back of live pitchers. The hood also is large. The pitchers of these plants are taller and broader at the top than either parent.

I have made others using the Okefenokee *S. minor*. So far only the *S.* × *areolata* cross with it is near maturity. It differs little from the *S. alata* cros but may not be as tall.

I have crossed the red-mouthed *S. alata* with *S. leucophylla* and with *S. purpurea* ssp. *venosa*. The *S. leucophylla* cross differs little from other plants of *S.* × *areolata* I have. The pitcher tops are a bit darker and the hood interior is red as in the *S. alata*. Because the *S. leucophylla* colour is not improved, this hybrid is not very attractive.

The cross between the red-mouthed *S. alata* and *S. purpurea* ssp. *venosa* shows the influence of the colour of *S. alata* in the colouring of the hybrid hood interior. The colour is soon masked as the whole pitcher reddens but the hood interior

remains darker than in hybrids where the green form of *S. alata* was used.

Having grown the Okefenokee Swamp *S. minor*, the red-mouthed *S. alata* and red form of *S. alata* (with the green lid which is red-veined) for more than ten years I have known for some time that their distinctive characteristics are not the result of growing conditions. They come true from seed if the plants are selfed and it is now evident that their distinctive characteristics are passed on to at least some of their hybrids and in some cases with very striking results.

In all cases the plants are grown outside in full sun. Winters here are very mild with rare frosts.

(See color photos, page 67.)

A Photographic Study of the Rapid Movements of Stalked Glands of the Cape Sundew *Drosera capensis*

Glenn Elzinga, John D. Beebe, and Randall Van Dragt
Biology Department, Calvin College, Grand Rapids, Michigan 49506

The movement of stalked glands and leaves of sundews is well known. The first record of modes of behavior of stalked glands and leaf blades in the genus Drosera can be traced to Dr. Roth in 1782 (Lloyd, 1942). Lloyd documented slow leaf blade movement of *D. capensis* in a sequence of frames from a time-lapse motion picture. Bopp and Weber (1981) have published photographs of slow leaf blade bending of *D. capensis* in a hormone regulation study. Williams (1976) reported on rapid stalked gland movement and slow leaf bending movement in photographs of *D. intermedia* taken by James Kowalchuk. In our present study we present photographs of *D. capensis* (Figure 1) which show the rapid stalked gland reponse (Figure 2) to the presence of an ether anesthetized fruit fly *(Drosophila melanogaster)*.

An anesthetized fruit fly was placed on the lateral extreme of the outer discal stalked glands of a *D. capensis* leaf blade (Figure 2a). The terminology is that of Lloyd (1942) reporting on the work of Behr who divided the stalked glands of *D. rotundifolia* into three groups progressing from the 1. marginal glands, 2. the outer discal glands, to the 3. discal or central group of glands. In one hour (Figure 2b) the fly had been coated with mucilage and had been carried medially a short distance by the extreme outer discal glands. At two hours (Figure 2c) the fly has been carried to the lateral margin of the discal or central glands. The extreme bending of the outer discal glands became apparent and the bending of the marginal glands can be seen. During the next two hours (Figures 2e and f) the position of the fly did not change appreciably; however, the progressive bending of the marginal glands continued. In a period of five hours the fruit fly was carried from a lateral position to a central position on the leaf blade and the outer discal and marginal glands have shown extreme bending.

The plants were two year old cuttings in 7.5 cm plastic pots containing a peat-vermiculite mix. The plants were grown in a glass case with a loose fitting cover and two 20 watt cool white fluorescent lights 5 cm from the top of the plant and 10 cm from the top of the pot. The plants were watered from the base with 1 to 2 cm of deionized water and allowed to dry slightly before the next watering. Between photo taking sessions the plants were covered with a glass beaker in order to maintain high humidity.

The photographs were made using a Canon F1 camera and Kodak Panatomic X film. The *D. capensis* habit photograph (Figure 1) was made using a 25 mm exten-

sion tube and a 50 mm macrolens with a lens to subject distance of 2 cm. The plant was 9 cm from a masked Sunpack ring flash. The gland movement series (Figs. 2-7) involved the use of a bellows extended 105 mm with a 50 mm macrolens at a distance of 2 cm from the lens to the subject and two flashes—one direct 30 cm from the subject and one reflected from a white card 20 cm from the subject. All exposures were f16 and 1/60 sec. Negatives were printed on Kodak Polycontrast Rapid II RC F paper.

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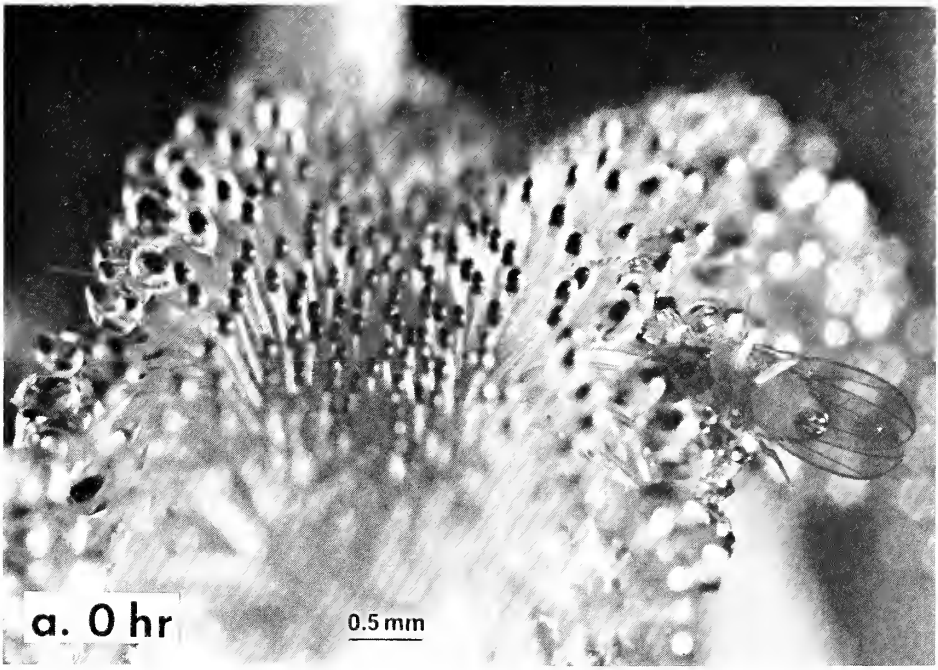
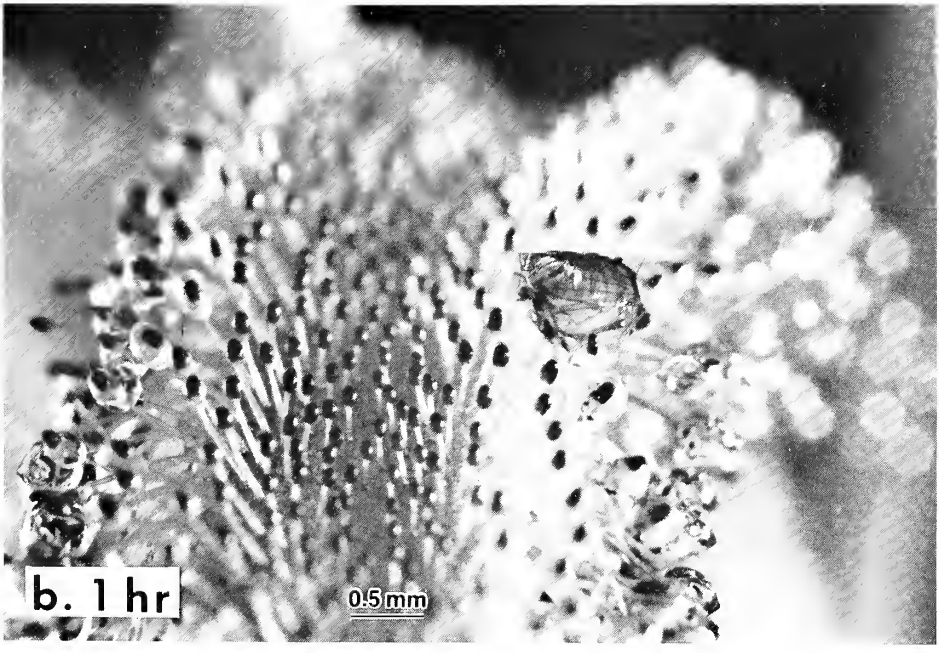
Williams, S. E. 1976. Comparative sensory physiology of the Droseraceae—the evolution of a plant sensory system. Proc. Amer. Phil. Soc. 120 (3): 187-204.

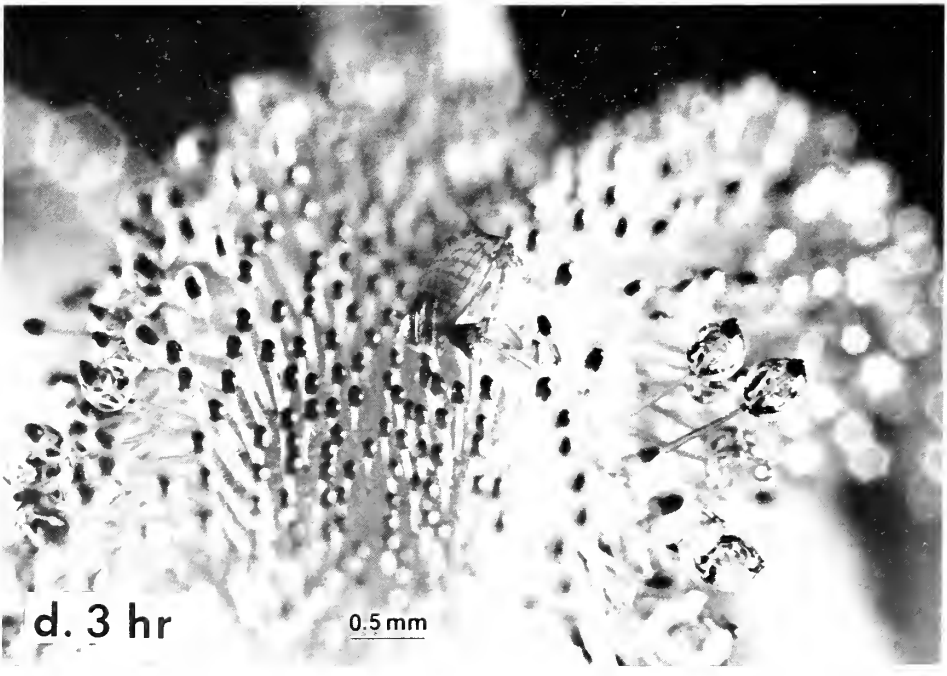
Figure 1. A two-year old cutting of Drosera capensis grown under lights in an artificial soil mix.



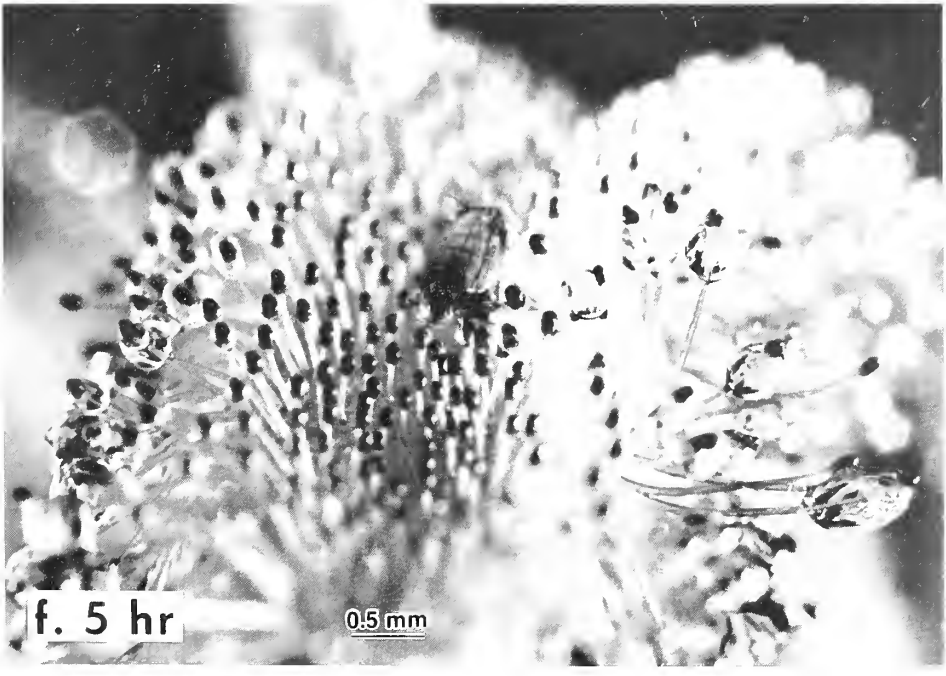
Figs. 2-7. Stalked gland movement of *Drosera capensis* in response to an anesthetized fruit fly during a five hour period.




c. 2 hr
0.5 mm


d. 3 hr
0.5 mm


e. 4 hr
0.5 mm


f. 5 hr
0.5 mm

Pollination (from page 62)

tions of plants which would have yielded information about cross-pollination, self-pollination, and actual seed set. Thus it will be necessary to attempt interpretations ofthe results while bearing in mind that the project was started a bit late for yielding conclusive results.

In Mandossian's thesis (1965), she reports four species of *Bombus* including *Bombus terricola* as frequent visitors to *Sarracenia* flowers. She observed them to be extremely active through most of the day, moving constantly from flower to flower, never staying long inside. She also reported entrace to be over the stigma. Mandossian observed large pollen loads on the *Bombus.*

The two *Bombus terricola* females caught in this study were the only two found in the flowers during the entire study period. They did have a fair amount of pollen grains on their bodies. Of the bee visitors, *Bombus* comprised only 4% of total insect visits. While it is possible that *Bombus* are pollinating *Sarracenia* at this site, it seems likely that they play only a very minor role, if at all.

Halictid bees seem to be the primary visitors to *Sarracenia* flowers.* They account for 95% of flower visitations. While they were observed to occasionally exit flowers across the stigma, and thus it could be suggested that the pollen which they gather while crawling about inside the flowers is deposited on the stigmatic surface and effects self-pollination, it is more reasonable to assume that since they normally enter the flower across the stigmatic surface (and exit between petal and stigma) that they are cross-pollinating the flower by depositing pollen as they enter.

Mandossian (1965) found that only 29% of flowers produced seeds that had insect visitors excluded and were left untouched. Sixty-four percent of the flowers which she self-pollinated produced seed, while 97% of the flowers that were cross-pollinated produced seed. This indicates that *Sarracenia purpurea* is self-compatible and can produce seed even in the absence of pollinators. It also shows, however, that insect visits that result in self-pollination can be beneficial. Unfortunately, it is impossible to evaluate the relative extent to which the Halictids cross- and self-pollinate *Sarracenia* in the present study. Interestingly, Mandossian (1965) does not mention Halictids as visitors at all. It is possible that this difference could be accounted for by habitat differences.

Decidedly, this study should be repeated for more conclusive results. It would be necessary to start much earlier — as early as the emergence of buds in order to determine quantitatively what is occurring in the flowers. This would enable bagging of plants, exclusion of visitors, outcrossing and self-crossing experiments. Specific plots could be designed wherein records of the visits to each plant could be kept. The period of stigma receptivity and pollen maturity should be determined as well. It might not be a bad idea to check the flowers a few more times at night – to eliminate or establish the possibility of moth visitors. Despite Mandossian's thesis on the life history of *Sarracenia* (1965), it might be a productive study if *Sarracenia* flowers were watched at a bog site and at this swale site during the same season. Thus, it could be established whether or not visitors to *Sarracenia* are specific to the plant and differ by latitude or whether they are specific to the habitat in which the plants exist.

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Harper, Roland M. 1918. The American pitcher plants. J. Mitchell Soc., Sept., 110-125.

Istock, C.A., S.E. Wasserman, and H. Zinmer. 1975. Ecology and evolution of the pitcher-plant mosquito: I. Population dynamics and laboratory response to food and population density. Evolution 29: 296-312.

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Mandossian, A.J. 1965. Some aspects of the ecological life history of *Sarracenia purpurea*. Unpubl. PhD. thesis, Michigan State Univ.

Schnell, D.E. 1978. Systematic flower studies of *Sarracenia*. Castanea 43: 211-220.

Review of Recent Literature

Earley, L. S. 1983. The alluring pitcher plant. (Illustrations by Carol Lerner). Wildlife in North Carolina 47 (6):2-3.

This half page popular article briefly describes the four sarracenias in North Carolina, but also features a one and a half page spread of Carol Lerner's excellent line drawings. (DES)

Earley, L. S. 1983. Two days in John Green's Swamp. Wildlife in North Carolina 47 (6): 14-21.

This is an excellent "color piece" describing exploring the Green Swamp in modern times, as well as an interesting historical review of the times and trials of the Swamp. The article is accompanied by good color photos, including a typical savanna and a clump of *Sarracenia flava.* (DES)

Grollman, J. Flesh Eaters at South Kensington. New Scientist, April 28, 1983.

The author describes the displays of CP at the Natural History Museum in London, which were exhibited between April 21 and June 3 in sealed glass cases. The Carnivorous Plant Society is sponsoring this exhibition to familiarize visitors with these fascinating plants.

Kondo, K. and Y. Yaguchi. 1983. Stomatal responses to prey capture and trap narrowing in Venus's flytrap *(Dionaea muscipula* Ellis). II. Effects of various chemical substances on stomatal responses and trap closure. Phyton 43: 1-8.

Application of various plant growth substances either stimulated or inhibited trap closure, and some caused the trap to remain closed for two or more days. Apparent fluid tension changes in subepidermal tissues suggest that water movement and transpiration rate are involved in trap movement. (DES)

Lounibos, L. P., C. Van Dover, and G. F. O'Meara. Fecundity, autogeny, and larval environment of the pitcher-plant mosquito, Wyeomyia smithii. Oecologia (Berl.) 55 (2): 160-164, 1982.

The authors collected pupae and 4th instar larvae from Alabama *Sarracenia purpurea* pitcher plants. They found that the females which emerged varied greatly in the production of mature eggs and didn't have any relationship to the density of larvae found in individual pitchers.

WANT ADS

When submitting Want Ads, please be sure to print clearly for best results and to eliminate mistakes. Please circle the correct letter before each item (Want, Trade, Sell or Buy). Want ads are limited to carnivorous plants, terrariums, greenhouses and moss. There is a charge of ten cents per item, with no limit to the number of items you may submit per issue.

Send coin or check to:
Arboretum, Want Ads
California State University
Fullerton, CA 92634

Richard Chinnock (3316 Old Dirkwood Dr., Virginia Beach, VA 23452). To sell: *Sarracenia* plants, too many to list. *Pinguicula lutea* plants, *Dionaea muscipula* plants. Send SASE for list and prices.

Curtis Yax (12 Division, Apt. 1, Oneonta, New York 13820). Trade: Gemmae of pygmy sundews. Send SASE.

C.G. Antoni (330 West 22 Street, New York, N.Y. 10011). Trade: Cuttings of *N.* × *coccinea* with any Nepenthes cuttings except *N. coccinea, khasiana,* and *kampotiana.*

Note: All individuals or organizations selling, trading or buying CP are advised to be cognizant of certain restrictions under the U.S. ESA and international CITES for certain species (see editorial).